BANA 5368.01: Techniques of Statistical Analysis

Fall 2017

Instructor:	Dr. Kevin Henning	**Time/Place:**	Online
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Prerequisites: Either a baccalaureate business degree or completion of Quantitative Tools for Business (BANA 5300).

Office Hours: Monday, 12:30 p.m. - 2:00 p.m. in Huntsville, Tuesday, 4:30 p.m. - 6:00 p.m. at The Woodlands Center, and by appointment (in person, over Skype, or by phone).

Materials:

- *Business Statistics*, 3rd edition, by Sharpe, DeVeaux, and Velleman. I use this book primarily as a source of non-graded practice problems (not to be turned in) and additional reading. Sometimes it helps to see material presented in different ways. Used copies are fine, and no course access key is required. ISBN: 978-0-321-92583-1

- R Commander, which is a graphical interface for statistical computing software R. This software can perform some graphical and numerical analysis tasks more quickly and easily than Excel "out of the box." The software is free, works on Mac and PC, and is available from r-project.org. Note for Mac users: There are a few extra steps in installing R Commander. See https://socserv.mcmaster.ca/jfox/Misc/Rcmdr/installation-notes.html for guidance. There are also many tutorial videos on installing R and R Commander on YouTube (see www.youtube.com/results?search_query=installing+R+commander **PC users: if you run into installation trouble, temporarily disable all antivirus/anti-malware software (e.g. Norton, McAfee, Malwarebytes, etc.) while you install R Commander.**

- A working computer and a reliable high-speed internet connection. Detailed information on system requirements can be found at online.shsu.edu/campus/support-desk/system-requirements.html.

Optional Text:

- Peter H. Westfall and Kevin S. S. Henning, *Understanding Advanced Statistical Methods*, Chapman Hall/CRC Press, ISBN: 978-1466512108. In this book, my coauthor and I discuss the nature of statistics as the science of modeling the natural world using concepts of randomness and probability. We demonstrate how and why statistical models are the ideal tool for making sense of the "real-world," in the sense that they are able to provide trustworthy estimations and predictions about the world. In addition, we cast a critical light on many commonly accepted statistical practices and highlight some myths and half-truths that have been perpetuated over the years. We go into detail on the behind-the-scenes theory that makes statistics "work" mathematically.

  This book is <u>optional</u>; no assignments or any other course work will come from this text.

Course Description and Objectives: Our world is now swimming in exabytes (billions of gigabytes) of data. "Statistics" is the collective term for the processes and procedures by which we analyze and transform data into information that, as fairly as possible, represents the true nature of some aspect of the world. Statistical methods drive discoveries in medicine, genetics, astronomy, neuroscience, psychology, economics, finance, human resources, marketing, and practically every other evidence-based science. In a business setting, statistical methods are used to find new markets, assess quality, make capital investment decisions, forecast sales and costs, and more. In addition, statistical methods have made possible services that could not exist without the ability to extract information and find patterns in data (think of Netflix, eHarmony, Uber, most online advertising, and mobile apps).

This course will give you an overview of the most commonly used quantitative methods of data analysis, with an emphasis on communicating the results clearly using generally accepted guidelines of effective writing. Topics will include hypothesis testing and confidence intervals for means and proportions, goodness-of-fit tests, correlation, and simple and multiple linear regression models. The focus will be placed on interpreting output, not simply performing calculations. The use of software for statistical analysis will be discussed in detail. Over the course of the semester, attentive students will:

1. Understand the role and importance of inferential statistical techniques in a business context.

2. Apply basic inferential statistical techniques (i.e., confidence intervals and hypothesis tests) for numerical and categorical variables using real (and realistic) data sets.

3. Understand and apply advanced concepts of correlation and regression (simple and multiple) in a business context.

4. Acquire a working knowledge of statistical analysis software.

5. Learn best practices for communicating the results of statistical analysis to a non-technical audience.

Organization and Delivery of Course Content: The following information tells you a little bit about what you can expect from the course so that you can start out in the best possible way.

- This course uses the usual Blackboard learning management system to deliver content. The material for the course is organized into content folders by topic rather than book chapter. Each content folder contains supplemental reading material (PowerPoint slides, handouts, links to relevant websites, etc.), lecture videos, and one or two automatically graded Blackboard homework assignments (see the discussion under "Blackboard Assignments" below).

- **This course is not completely self-paced.** Exams and assignments will open and close at certain times for everyone, and some group work is required (more details are given below).

- Due to the nature of the material, **you might find this course to be more challenging than others you have taken in the program.** How challenging you will find the course will depend upon your undergraduate background, how long it has been since you have had a statistics course, your employment experiences (some people use statistics every day), and your individual learning style. Reading the course material and watching the lecture videos are essential activities for many students in the course. For others who have had statistics courses more recently, less work may be required.

- To balance out the additional challenge the course offers (if any), I devote a large amount of time toward being actively involved in the course and accessible through email, discussion board postings, detailed grading feedback on exams, and frequent announcements. **I am not a "set it and forget it" instructor.**

- There is a lot of information about statistics on the internet; no big surprise there. However, **this is not a "Google Your Way to an A" course. A significant amount of material is of my own creation.**

- Through analyzing student feedback over the years, I have come up with the following list of suggestions:

  - Don't panic at the amount of material that is covered! Take things one step at a time, asking questions along the way. The number of topics covered is not out of the ordinary for any one-semester MBA statistics course.

  - In online sections of the course, lecture videos are meant to give you the same course material as you would get in a regular weekly face-to-face setting. Try setting aside a specific time and/or place to watch the videos each week so that you get into a routine.

  - If you have had a statistics course recently, or the material in a video feels familiar, try skipping ahead to a segment in which I work problems to see if you can follow me. If not, then watch earlier segments of the video.

  - Because you have several attempts for each Blackboard assignment, I suggest first opening each assignment when it becomes available and printing it out so that you can identify key parts of the lectures. Working out the calculations on paper and then inputting them into Blackboard is more effective for some students.

  - Take breaks. Most videos are broken up into three or more segments. If you are feeling overwhelmed, don't watch the videos all at once. Watch one segment, go do something else, and then come back and watch another.

  - **Ask questions early and often through the discussion board (see below). By its nature, statistics builds upon itself. If you are unsure of the concepts discussed early on and do not seek help, you will have trouble understanding later material.** Conversely, if you have a solid understanding of the basic concepts, you will likely find the later material to be easier.

  In general, try to keep the big picture in mind as you work through this and other courses in your program. An MBA degree has value–to you, to your current and future employers, and to society at large–**precisely** *because* **extra effort is required beyond that of a bachelor's degree.**

Technical Support Information: As with any online resource, Blackboard doesn't work perfectly all the time. But the problems are usually minor, temporary, and easy to work around. If you encounter any **technical** problems with submitting an assignment or with any other aspect of course functionality, please **do not contact me until you have contacted the SHSU Online Support Desk** at 936-294-2780, or blackboard@shsu.edu

(otherwise, I will always just tell you to contact them first anyway, so save the time and do so). Hours of operation and other information can be found at online.shsu.edu/campus/support-desk/index.html. Note that SHSU Online does not provide tutoring services and is not responsible for course policies, due dates, organization, or content. Questions regarding these items should be directed to the instructor.

If you are unable to solve the problem with the support technicians, ask them to give you a case/incident number and **then** contact me so that I can verify your issue and, if needed, discuss it with SHSU Online.

Grading: Your grade will be a weighted average of the items in the following table. **I do not use Blackboard's point system!** Information about each item appears after the table.

Component	Weight
Two (2) exams	50%
Data analysis assignments	30%
Blackboard homework assignments	15%
Work group peer evaluation	5%

The cutoffs for letter grades are as follows: 90-100–A; 80-89–B; 70-79–C; 69 and below: F (a grade of D is not possible in a graduate course).

Exams: In calculating your final grade, I will weight each exam according to your performance on it. The highest exam will be weighted 30% and the lowest exam will be weighted 20%. The first exam will be taken approximately halfway through the course and will serve as the midterm. The second exam will be taken during the final exam period (see the schedule below). However, for grading purposes the second exam will be treated as just another exam.

Exams must be taken at the day and time (or, for online classes, during the window of time) listed in the syllabus unless the absence arises from any of the following activities:

- documented, legitimate school-sponsored or career-related activities (job fairs, work emergencies, etc.)

- observances of religious holy days (see below)

- other *emergencies* (hospitalizations, funerals, child care issues, major accidents, court dates, jury duty, deployments etc.)

If you miss an exam due to one of these reasons, **you must contact me within two (2) *calendar days* of the absence** to see what documentation you need to show me to excuse the absence. For example, acceptable documentation for a medical emergency is a letter from a licensed medical professional on his or her practice or group letterhead explaining why you are unable to take the exam as scheduled. For other emergencies, please speak with me about what forms of documentation I require. **Failure to contact me within the above time window will result in a grade of zero (0) on the exam, with no possibility to make up the grade. No exams will be dropped for any reason.**

Data Analysis Assignments: Over the course of the semester, you will complete a few data analysis assignments. Typically, these will require you to use software such as R or Excel. Instructions for installing this specialized software will be given at the beginning of the semester, and instructions on how to use it to accomplish specific analysis objectives will be presented as we go. It is **your responsibility** to ask me questions any time you encounter an issue with the software or have a question about an assignment.

ASSIGNMENT GUIDELINES: To give you practice with communicating the results of statistical analyses in a clear and concise way, all assignments must be typed in a word processing program such as Word, OpenOffice/LibreOffice Writer, Google Docs, etc. Mathematical symbols and formulas, when needed, should be written using the program's built-in equation editor (please ask me if you have any questions about how to do this).

A large portion of the assignment grade will be based on how well you communicate your findings and conclusions. This means that assignments should be written in a clear, professional, and grammatically correct manner that is understandable to anyone with a basic statistics background. When in doubt, err on the side of explaining too much rather than too little. Additional guidelines for completing assignments will be provided as needed.

Assignments must be submitted as a single, self-contained document to the Turnitin drop box provided on Blackboard (I will not accept assignments sent via email, fax, or hard copy). Assignments will be automatically scanned for plagiarism from other papers in the class, from outside sources, and from papers submitted by students in previous semesters. Whenever you incorporate outside elements into your work–thoughts, facts, opinions, graphs, images, tables, or any other material that is not your original creation–you **must provide a full citation of the original source using American Psychological Association (APA) format.** An excellent online resource is the Purdue Online Writing Lab (OWL) found at owl.english.purdue.edu/owl/. Failure to cite the sources you use **constitutes plagiarism, a serious academic offense** with a penalty ranging from a significant deduction of points on the assignment up to **expulsion from the class and/or MBA program.** Therefore, err on the side of caution: when in doubt, include a citation. Note however, that unless an assignment specifically calls for it, I do not expect you to incorporate outside sources as a matter of routine.

WORK TEAMS: Assignments must be completed in groups of three (3) to four (4) people, with all members of the group sharing the grade. If your group size drops below three (3) due to students withdrawing from the course, I reserve the right to move the remaining members into existing groups or form new groups, as needed, so that all teams consist of at least three people.

Teamwork in an online setting can sometimes be challenging, but there are many free resources that make collaboration easier. I recommend Google Hangouts (hangouts.google.com/), which only requires an active Gmail account. A particularly useful feature of Google Hangouts is the ability to share your screen view with everyone in your group simultaneously, thereby making it easier for everyone to contribute to the assignment. I recommend using Hangouts with Google Drive (accessible from your Gmail account) to help with the sharing and editing of a single document among several users.

Most of the time, members of a work team in a graduate course are mature enough to work together, accommodating one another's schedules and resolving disputes. In extreme cases of group dysfunction, I am willing to help resolve the dispute, but you **must bring the problem to my attention. I do not regularly monitor the activities of the groups, and will take the default stance**

of "everything's okay" unless you tell me otherwise. When bringing a group conflict to my attention, you should be prepared to demonstrate (e.g., using copies of emails or a discussion of specific incidents) that your group is unable to work with the person in question. In some cases, I will allow the group to "fire" the individual causing the disruption. In most other cases, you should find the work group peer evaluation (see below) sufficient to account for variation in group member participation.

Blackboard Assignments: Corresponding to each course folder in Blackboard will be an automatically graded assignment that is intended to give you practice with the key concepts in the module. Here are some details:

- **These assignments are not actual tests.** Even though Blackboard calls them "tests," think of them as homework. Feel free to consult me, your classmates, tutors, and study partners for help. Be aware, though, that on many problems, the numbers or answer choices will be different for each student. Therefore, **copying off of another student's assignment will result in a bad grade.** In addition, you will encounter problems like those in the assignments on exams, so you will need to understand how to work all of the problems.

- You can go in and out of each Blackboard assignment as many times as you want. In addition, there is no time limit other than the due date. Therefore, you can work each assignment a little at a time (this is the approach I recommend).

- You will have three (3) opportunities to complete each Blackboard homework assignment, and I will take the highest grade earned at the end of the semester for each one. For example, if you take Assignment 1 three times and earn a 40 on your first attempt, a 95 on your second, and an 85 on your third, your grade for Assignment 1 will be $max(40, 95, 85) = 95$ for that assignment when I calculate final grades.

- Many students find that printing out the assignments before working them helps them focus on the key components of the video lectures. Printing out an assignment does not require you to sacrifice one of your attempts.

- **Each assignment attempt is independent of the others.** Individual questions that you got right or wrong on one attempt have no impact on the grade of any other attempt; that is, you cannot swap correct answers from previous attempts into another attempt to increase your grade. For example, if you get Question 3 correct on your lowest attempt, but incorrect on your highest attempt, you **do not** get credit back for having gotten Question 3 correct on a previous attempt.

- Blackboard sometimes experiences technical problems. If you are having difficulty submitting an online assignment, or have a technical question contact SHSU Online support.

Peer Evaluation Assignment: During the last week of class, you will have the opportunity to evaluate yourself and the other members of your work group on the degree and quality of the work performed on the data analysis assignments. Each person in the group will have [group size] ×5 points to allocate any way he or she sees fit. A student's final participation grade is the percentage of the maximum possible points that student has been assigned by all team members.

An example of equal allocation (the ideal case) for a group of 3 is given below. Alice, Bill, and Charlie all agree that everyone participated equally over the semester.

Equal Allocation (Ideal)	Alice	Bill	Charlie
Alice	5	5	5
Bill	5	5	5
Charlie	5	5	5
Total	15	15	15
Grade $\left[= \frac{\text{Column Sum}}{15} \times 100\right]$	**100**	**100**	**100**

Here is an example of unequal allocation, in which Alice believes Bill did not do his fair share of the work but Bill thinks that he and Charlie both did their fair share. Further, Charlie thinks that Alice did not do her fair share. **Notice the rows still total to 15**.

Unequal Allocation	Alice	Bill	Charlie
Alice	8	2	5
Bill	5	5	5
Charlie	1	5	9
Total	14	12	19
Grade $\left[= \frac{\text{Column Sum}}{15} \times 100\right]$	**93**	**80**	**127**

The work group evaluation portion of the final grade should, ideally, be an "easy 100" because by the time of the evaluation (at the end of the semester), you should have either worked to resolve any disputes or, for extreme cases, contacted me for assistance in these matters (see "WORK TEAMS" above for more details). However, please feel free to use this tool to assign participation points to your group as you see fit.

Textbook Problems: Although there will be no graded homework assigned from the textbook, I have provided a list of relevant problems from chapters in the Sharpe, DeVeaux, and Velleman book at the end of the syllabus to give you extra practice on the concepts should you feel you need it. Answers are located in the back of the book. **All material that you are responsible for knowing for exam purposes will come from my lectures, PowerPoints, and handouts. You won't find any surprise questions from the Sharpe et al. textbook on an exam or assignment.**

Communication Expectation: The goal of this course is to give you practice with applying the concepts and tools of statistics in realistic contexts. Oftentimes, there are many ways to convey a

concept or approach a problem, and how I present something in a lecture may leave you with several questions. **Please reach out to me for help! I** <u>expect you to ask me questions!</u> It is almost a guarantee that several other students will have the same question as you do on any given topic.

To ensure that your questions are answered as quickly and efficiently as possible, if you cannot meet with me in person during office hours or after class (as is the case if you are taking the course online), follow the guidelines below:

- If your question **only pertains to you** (such as a question about your grades, attendance/course activity, an emergency, or some other personal matter relevant only to your performance in the course) **and it is not related to a technical problem in Blackboard,** email or call me using the contact information on the first page of the syllabus.

- If you are having trouble accessing Blackboard, viewing or opening an assignment or test, accessing your grades, or experiencing any other technical problem, contact the SHSU Online Support Desk using the contact information above. They will inform you about whether or not you need to contact me.

- If your question **involves the course content** (such as how to think about a problem, a statistical concept you don't understand, a course policy or deadline, or any other general-interest question) log into the Blackboard page for this course at blackboard.shsu.edu and **post your question in the "Questions for the Instructor" discussion board forum (I don't monitor any other forums).** I will answer discussion board questions <u>within 24 hours on weekdays</u> and <u>within 48 hours on weekends.</u> **Therefore, do not wait until the last minute before something is due to ask a question.**

    Here are some guidelines for asking content-related questions:

    - **Do not simply ask if your answer to a problem is right or not.** You need to show or explain in your post everything you did up to the point you are unsure of. Concepts are vastly more important than calculations, especially at the MBA level.

        For example, "Is the correct answer to Problem #6 2.4?" is a **BAD question** because it doesn't indicate your thought process. Writing "On Problem 6, it looks like I need to find the average. I found the average by taking $(2.1+3.6+1.3+2.6)/4$. Is that the right approach?" is better.

    - When asking for help on a problem, **provide the full text of the question**. I don't have every word of every problem of every assignment in my head at all times (but I'm flattered some students think I do).

        For example, don't simply say "I need help with #12." What #12 are you talking about? Give me details. Say something like "I need help with Question 12 on Assignment 3," and then provide the **full text of the question** and what specific part you need help with.

    Remember, **ask questions when you do not understand something. The earlier the better.**

Extra Credit: One (1) point of extra credit on the highest-weighted exam (up to a maximum score of 105) will be awarded for each mistake found in any course material created by me that is brought to my attention via email. A "mistake" is any grammatical, typographical, mathematical, or factual error. A student may earn up to ten (10) extra credit points. In the event of multiple reports of the same mistake, I will determine which student gets the points by the time stamp on his/her email. (If you are reading this for the first time at the end of the semester in desperate need of points, all I can say is: oops...). Reports of mistakes in material not created by me (e.g., typos in a textbook or errors in outside reading material that you encounter) do not count toward the 10 points, but are greatly appreciated.

Other extra credit opportunities or points may be assigned to the class at my discretion. Any such extra credit assignment will be made available to the entire class. **No individual extra credit assignments will be offered. In addition, if you have not done all of the "regular credit" assignments, you are not eligible for any extra credit.**

Academic Dishonesty: SHSU expects all students to engage in academic pursuits in a manner that is above reproach, and to maintain complete honesty and integrity in academic experiences both in and out of the classroom. The University and its official representatives, acting in accordance with Subsection 5.32 of Academic Policy Statement 810213, may initiate disciplinary proceedings against a student accused of any form of academic dishonesty or cheating. "Cheating" includes, but is not limited to:

- Copying from another student's test paper, laboratory or other report, computer files, data listings, and/or programs;

- Using, during a test, materials not authorized by the instructor, including "homework help" websites, discussion boards, and chat rooms;

- Collaborating, without authorization, with another person during an examination or in preparing academic work;

- Knowingly, and without authorization, using, buying, selling, stealing, transporting, soliciting, copying, or possessing, in whole or in part, the contents of an unadministered test;

- Substituting for another student, permitting any other person, or, otherwise assisting any other person to substitute for oneself or for another student in the taking of an examination or test or the preparation of academic work to be submitted for academic credit, placement, or qualification. **For face-to-face classes, this includes signing an attendance sheet for someone else!**

- Bribing another person to obtain an unadministered test or information about an unadministered test;

- Purchasing, or otherwise acquiring and submitting as one's own work, any research paper or other writing assignment prepared by an individual or firm.

"Plagiarism" means the appropriation and the unacknowledged incorporation of another's work or idea into one's own work. In other words, if you use another person's words, ideas, or artwork and do not clearly indicate in your paper that you have done so (such as with a reference in a standard citation format) you have committed plagiarism.

Penalties for violations of the above policies include, but are not limited to, a significant grade deduction on the assignment, a zero for the assignment, or a failing grade in the course. If I believe that additional disciplinary action is necessary, as in the case of flagrant or repeated violations, the case may be referred to the Dean of Student Life or a designated appointee for further action. If the student involved does not accept my decision, the student may appeal to the chair of the appropriate academic department/school, seeking reversal of the faculty member's decision.

These and other academic policies may be found at shsu.edu/dept/academic-affairs/aps/aps-students.html

Course Access Expectation: Because of the mathematical content in the course, **you will almost certainly fall behind if you do not regularly log into the course.** I refer all students who do not log into Blackboard regularly to the Sam Houston State First Alert service. Personnel from that office assemble a file on the student and attempt to contact him or her by telephone, email, and regular mail to determine the reason for the lack of activity.

ADA Accommodations: It is the policy of Sam Houston State University ("University") that individuals otherwise qualified shall not be excluded, solely by reason of their disability, from participation in any academic program of the University. Further, they shall not be denied the benefits of these programs nor shall they be subjected to discrimination. Students with disabilities that might affect their academic performance should register with the Office of Services for Students with Disabilities located in the Lee Drain Annex (telephone 936-294-3512, TDD 936-294-3786, and e-mail disability@shsu.edu). They should then make arrangements with their individual instructors so that appropriate strategies can be considered and helpful procedures can be developed to ensure that participation and achievement opportunities are not impaired.

SHSU adheres to all applicable federal, state, and local laws, regulations, and guidelines with respect to providing reasonable accommodations for students with disabilities. If you have a disability that may affect adversely your work in this class, then I encourage you to register with the SHSU Services for Students with Disabilities and to talk with me about how I can best help you. All disclosures of disabilities will be kept strictly confidential. NOTE: No accommodation can be made until you register with the Services for Students with Disabilities. For a complete listing of the University policy, see shsu.edu/dotAsset/7ff819c3-39f3-491d-b688-db5a330ced92.pdf

Student Observance of Religious Holy Days: Section 51.911 (b) of the Texas Education Code requires that an institution of higher education excuse a student from attending classes or other required activities, including examinations, for the observance of a religious holy day, including travel for that purpose. A student whose absence is excused under this subsection may not be penalized for that absence and shall be allowed to make up an examination or complete an assignment from which the student is excused within a reasonable time after the absence. "Religious holy day" means a holy day observed by a religion whose places of worship are exempt from property taxation under Section 11.20, United States Tax Code.

If you do not inform me of upcoming absences related to this policy, I reserve the right to enforce the standard late work and make-up policies (that is, no late work or make-up work accepted).

Tentative Course Outline: This is an **approximate** schedule to give you an overview of the course. I reserve the right to make adjustments as needed to keep the course on track. Due dates for the two exams, the Blackboard ("BB") assignments, and data analysis ("DA") assignments are given in bold; **all due times are 11:59 p.m. central time.** Readings from the supplemental *Business Statistics* textbook by Sharpe et al. are indicated by "Chapter <number>." These topics are covered in handouts I provide on Blackboard. **Readings from my material are priority.** The purpose of the textbook is to give you an alternative–but equivalent–perspective on the material.

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Week of	Topics	Textbook Reading
8/21	review prerequisite material; review of descriptive statistics	skim Chapters 1-3
8/28	graphical and numerical descriptive techniques; overview of R Commander, Excel; **Prerequisite Math Self-Test due 9/3**	Chapter 3
9/4	random variables, expected value, and variance; normal distribution	Chapters 6 and 7
9/11	sampling distributions and the central limit theorem; confidence interval concepts; confidence intervals for means; **BB Assignment 1 due 9/17**	Chapters 11
9/18	hypothesis tests for means; intervals and tests for proportions	Chapters 9 & 10
9/25	confidence intervals and hypothesis tests for two means; **BB Assignment 2 due 10/1**	Chapter 12
10/2	continue inference for two means; inference for proportions; chi-squared tests (goodness-of-fit and independence); **DA Assignment 1 due 10/8**	
10/9	**Exam 1 opens at 12 p.m. on Thursday, 10/12, and closes Saturday, 10/14, at 11:59 p.m.; BB Assignment 3 due 10/15**	
10/16	correlation and simple linear regression with R and Excel; **BB Assignment 4 due 10/22**	Chapters 4 and 15 (Sections 15.1-15.2)
10/23	Using the simple linear regression model (inference for parameters; prediction; measures of fit)	Chapter 15 (Sections 3-4); Chapter 16 (Sections 16.1-16.3)
10/30	overview of multiple regression (interpretations, inference, model F Test)	Chapter 17 (skip 17.6)
11/6	Gauss-Markov theorem, non-linear regression; transformations **BB Assignment 5 due 11/18**	Chapter 16 (Sections 16.6-16.7); Chapter 18 (Section 6)
11/13	dummy variables, interaction; multicollinearity	Chapter 18 (Sections 1-2; 5)
11/20	model building; autocorrelation	Chapters 16 (Section 5); Chapter 18 (Section 4)
11/27	logistic regression and time series concepts (time permitting); **DA Assignment 2 due 12/3**	Chapter 17 (Section 6); Chapter 19 (Section 6)
12/4	**Exam 2 opens Wednesday, 12/6, at 12 p.m. and closes Friday, 12/8; BB Assignment 6 due Saturday, 12/9**	

Suggested Practice Problem List

This is a list of problems from the textbook that give you additional practice with the concepts in the course. Answers are given in the back of the book. These problems are not to turn in for a grade; they are for extra practice only.

1. **Introduction to Statistics**

   Chapter 1: 3; 9; 13; 15; (don't worry about "the W's" it asks for; just identify variables as quantitative or categorical)

2. **Describing Data Visually and Numerically**

   Chapter 2: 15; 17; 19; 25

   Chapter 3: 5; 7; 9; 19; 21; 45; 57

3. **Probability**

   Chapter 5: 1; 3; 5; 7; 11; 15; 23; 27; 33; 35; 49; 53; 55

4. **Random Variables and Probability Distributions**

   Chapter 6: 1; 3; 5; 9; 11; 19; 21; 23; 37

5. **Continuous Distributions**

   Chapter 7: 7; 23; 25; 27; 29; 31; 33; 35; 37

6. **Sampling Methods and Sampling Distribution of the Sample Mean**

   Chapter 11: 1; 3; 5

7. **Confidence Intervals and Tests for Means**

   Chapter 11: 25; 27 (**this one is extremely important!**); 35; 37; 41; 53

   A Note on the P-Value
   The book discusses using the **p-value** for hypothesis tests as part of the answer. The p-value (short for "probability value") is the probability that we would observe a value of the test statistic at least as extreme as what we actually observed **IF** H_0 were true. The *smaller* the p-value, the *stronger* the statistical evidence is against the null hypothesis. The p-value is another way to perform Steps 3 and 4 of the general hypothesis testing procedure, and is the method used in practice the most. However, without software, p-values cannot be calculated exactly. Fortunately, there is an easy rule for using p-values that **applies to every kind of hypothesis test:**

   if the p-value $\leq \alpha$, reject H_0; otherwise, fail to reject H_0.

   For example, if you see that "p-value = 0.03," and the level of significance $\alpha = 0.05$, you would reject H_0 because $0.03 < 0.05$.

   Chapter 11: 47; 49; 51

   Chapter 12: 23; 27; 33

8. **Intervals and Tests for Proportions**

   Chapter 9: 11; 13; 49; 51; 53

   Chapter 10: 11; 23; 27; 35

9. **Intervals and Tests for Two Means and Two Proportions**

   Chapter 13: 3; 5; 9; 27; 33; 37; 41; 49

   Chapter 14: 29; 31

10. **Chi Squared Tests**

    Chapter 14: 7; 11; 19; 27

11. **Correlation and Simple Linear Regression**

    Chapter 4: 1; 3; 25; 29; 31; 33

    Chapter 15: 1; 5; 7; 15; 18

12. **Multiple Linear Regression**

    Chapter 17: 1; 3; 15; 25

    Chapter 18: 1; 17; 21; 27

    Chapter 16: 29; 39; 49; 53

Suggested Practice Problem List

This is a list of problems from the supplemental textbook by Sharpe, DeVeaux, and Velleman that give you additional practice with the concepts in the course. Answers are given in the back of the book. These problems are not to turn in for a grade; they are for extra practice only.

1. **Introduction to Statistics**

   Chapter 1: 3; 9; 13; 15; (don't worry about "the W's" it asks for; just identify variables as quantitative or categorical);

2. **Describing Data Visually and Numerically**

   Chapter 2: 15; 17; 19; 25

   Chapter 3: 5; 7; 9; 19; 21; 45; 57

3. **Probability**

   Chapter 5: 1; 3; 5; 7; 11; 15; 23; 27; 33; 35; 49; 53; 55

4. **Random Variables and Probability Distributions**

   Chapter 6: 1; 3; 5; 9; 11; 19; 21; 23; 37

5. **Continuous Distributions**

   Chapter 7: 7; 23; 25; 27; 29; 31; 33; 35; 37

6. **Sampling Methods and Sampling Distribution of the Sample Mean**

   Chapter 11: 1; 3; 5

7. **Confidence Intervals and Tests for Means**

   Chapter 11: 25; 27 (**this one is extremely important!**); 35; 37; 41; 53

   A Note on the P-Value

   The book discusses using the **p-value** for hypothesis tests as part of the answer. The p-value (short for "probability value") is the probability that we would observe a value of the test statistic at least as extreme as what we actually observed **IF** H_0 were true. The *smaller* the p-value, the *stronger* the statistical evidence is against the null hypothesis. The p-value is another way to perform Steps 3 and 4 of the general hypothesis testing procedure, and is the method used in practice the most. However, without software, p-values cannot be calculated exactly. Fortunately, there is an easy rule for using p-values that **applies to every kind of hypothesis test:**

   if the p-value $\leq \alpha$, reject H_0; otherwise, fail to reject H_0.

   For example, if you see that "p-value = 0.03," and the level of significance $\alpha = 0.05$, you would reject H_0 because $0.03 < 0.05$.

   Chapter 11: 47; 49; 51

   Chapter 12: 23; 27; 33

8. **Intervals and Tests for Proportions**

   Chapter 9: 11; 13; 49; 51; 53

   Chapter 10: 11; 23; 27; 35

9. **Intervals and Tests for Two Means and Two Proportions**

   Chapter 13: 3; 5; 9; 27; 33; 37; 41; 49

   Chapter 14: 29; 31

10. **Chi-Squared Tests**

    Chapter 14: 7; 11; 19; 27

11. **Correlation and Simple Linear Regression**

    Chapter 4: 1; 3; 25; 29; 31; 33 Chapter 15: 1; 5; 7; 15; 18

12. **Multiple Linear Regression**

    Chapter 17: 1; 3; 15; 25

    Chapter 18: 1; 17; 21; 27

    Chapter 16: 29; 39; 49; 53